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# Ethanol ties up metal fabricators

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It's not a Texas oil boom, but a surge in ethanol production has generated millions of dollars in business for Wisconsin companies that make equipment for ethanol refineries.

In some cases, metal fabrication shops have turned away work because they're so busy cutting, welding and shaping stainless steel into large ethanol tanks. At least one shop is doubling the size of a production plant and hiring about 60 more people to handle the increased business.

"There's so much work out there, we will fill the expanded plant within a year," said Glenn Linzmeier, president of A&B Process Systems, a Stratford company that makes ethanol production equipment.

"We know the next three years will be real solid," he added.

Ethanol, usually made from corn, is blended with gasoline and used as automobile fuel. Ethanol advocates say its high oxygen content allows car engines to burn fuel more efficiently, resulting in reduced tail pipe emissions.

The state Assembly has passed a bill that would require ethanol to make up 10% of regular-grade gasoline. Gov. Jim Doyle has said he supports the measure, and it's under consideration in the Senate.

Wisconsin has four ethanol plants. Another plant is under construction in Dunn County, and several others are on the drawing board.

But even if Wisconsin motorists didn't use another drop of gasoline blended with ethanol, metal fabrication companies here would still be busy making ethanol plant equipment shipped to other states and countries.

Nationwide, there are 31 plants under construction. Ten plants are undergoing expansions, according to the American Coalition for Ethanol, a Sioux Falls, S.D., trade group.

Many of the metal fabricators that build equipment for the dairy industry and food processing companies are now getting sales from ethanol plants.

Five years ago, ethanol equipment comprised about 5% of A&B Process Systems' sales. Now it's 30% based on a much higher sales volume of about $50 million per year, according to the company.

"We have seen extreme growth in ethanol in the last two years," Linzmeier said. "And our sales in the ethanol industry should double next year. We will be pretty cramped for space by the time we open our new plant."

Paget Equipment Co., Marshfield, has months worth of ethanol equipment orders on its books. The steel fabricator has added a second shift and hired more workers to keep up with demand for equipment.

"We actually have turned work away on ethanol," said Brian Johnson, a company project engineer. "Right now, we have a workload that takes us out to next summer . . . and that's just with ethanol."

Paget makes heat exchangers and evaporation equipment used in turning corn into ethanol. It takes about a year to build an ethanol plant, and the $65 million spent on one of the projects has a big impact on suppliers such as Paget.

"It's all stainless steel, which is high-end work," Johnson said.

## A learning experience

When Ace Ethanol built a plant near Stanley, the company hired some Wisconsin metal fabricators who had never worked for the ethanol industry. Once the plant started up in 2002, the fabricators had enough experience to pursue other ethanol projects.

"We exposed them to new business on a national and even international scale," said Alexander Samardzich, Ace Ethanol president and president of the Wisconsin Ethanol Producers Association.

"The skills that some of these companies had from the dairy equipment industry transferred almost directly" to ethanol, he added.

Apache Stainless Equipment Corp. built a 160-foot ethanol production tank that weighed 220,000 pounds. It was one of the company's largest projects and was shipped to Kansas by truck, in one piece, in a 600-mile trip that took four days.

Production of ethanol equipment now comprises about 25% of the work at Apache, said Mike Peterson, sales manager for the Beaver Dam company.

"The ethanol business is at an all-time peak," he said. "We have guys telling us they are booked solid with work for at least another 18 months. We would add more employees, but it's hard to find people such as skilled welders."

Wisconsin has more than 2,000 businesses that fabricate metal. It's the largest segment of the state's manufacturing industry, employing more than 68,000 workers, according to the state Department of Workforce Development.

## Stubbed toes

Ethanol plants have created a boomlet for steel fabricators, but some people question the environmental benefits of ethanol-based fuel and say the fuel does more harm than good.

The plants have drawn some criticisms, too.

In 2004, Ace Ethanol paid a $300,000 fine for environmental regulation violations. Federal and state complaints alleged that Ace started building its plant without getting appropriate permits, and that it didn't install necessary air pollution-control equipment.

When a brewery in Minnesota was converted to produce ethanol, residents in the area complained about air emissions that made them ill, said Gene Anguil, founder and chairman of Anguil Environmental Systems, a Brown Deer company that builds pollution control equipment.

Some residents of Milton, in Rock County, protested plans for an ethanol plant there. But new technology has improved the industry's track record for the environment and being neighbor-friendly, said John Malchine, president of Badger State Ethanol in Monroe.

"There were miscalculations made in some plants built in the 1990s, but I think we have that behind us now," he said.

The ethanol equipment boom is likely to last at least a few more years, according to metal fabricators.

"One of our major customers is considering several plants overseas," said Ron Herman, A&B Process Systems' sales director. "Ethanol is getting outside of the Midwest now, and the Midwest isn't saturated yet, either."

Many plants operate 24 hours a day, 365 days a year. So there are opportunities for metal fabricators and other suppliers to stay involved through maintenance contracts.

"It's pretty much continual," Samardzich said. "We always have engineering consultants looking at our plant, trying to find ways to make it more efficient."



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washingtonpost.com

# In N.C., A Second Industrial Revolution

Biotech Surge Shows Manufacturing Still Key to U.S. Economy

By Peter S. Goodman
Washington Post Staff Writer
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PITTSBORO, N.C. -- Until the late 1950s, the low-slung brick building in the center of this minuscule town was home to the Kayser-Roth hosiery mill. Some 400 workers tended to clattering looms, churning out pantyhose.

"It was the best employer in town," said Nancy May, a former worker.

The hosiery mill is gone now, along with much of the Carolina textile industry -- a casualty of the global reordering that has concentrated production in Asia and Latin America. But the old brick building is still here and still making products -- albeit modern varieties that could scarcely have been imagined a half-century ago: Today, the site is occupied by a biotechnology company, Biolex Therapeutics.

Inside, 90 workers harness expensive laboratory equipment and a plant called duckweed, a bane to local ponds, to develop a drug for a serious liver ailment. Even the lowest-paid lab technician takes home far more than the seamstresses earned. If the start-up succeeds, its product will be substantially more lucrative than pantyhose.

As lawmakers pursue legislation aimed at softening the blow from factory closures, and as the downside of trade emerges as a talking point in the 2008 presidential campaign, it might seem that manufacturing is a dying part of the U.S. economy. But the retooling of this old brick building on Credle Street underscores how, despite its oft-pronounced demise, American manufacturing is in many regards stronger than ever.

The United States makes more manufactured goods today than at any time in history, as measured by the dollar value of production adjusted for inflation -- three times as much as in the mid-1950s, the supposed heyday of American industry. Between 1977 and 2005, the value of American manufacturing swelled from $1.3 trillion to an all-time record $4.5 trillion, according to the Bureau of Economic Analysis.

With less than 5 percent of the world's population, the United States is responsible for almost one-fourth of global manufacturing, a share that has changed little in decades. The United States is the largest manufacturing economy by far. Japan, the only serious rival for that title, has been losing ground. China has been growing but represents only about one-tenth of world manufacturing.

But if the big picture is brighter than many realize, American manufacturing is nevertheless undergoing fundamental change that is exerting enormous pressure on workers.

Imports are rising, now representing a third of all manufactured goods consumed in the country, up from 10 percent in the 1970s.

American exports are rising even faster than imports, but companies face intense price competition, with China, India, Brazil and dozens of other low-wage countries now part of a global marketplace for labor and materials. Manufacturers are redesigning production lines to make them more efficient, substituting machinery for people wherever possible.

So while American manufacturing is not declining, manufacturing employment has been shrinking dramatically. After peaking in 1979 at 19 million workers, the American manufacturing workforce has since dropped to 14 million, the lowest number since 1950.

A stark educational divide has emerged on the factory floor, as skills and training separate winners from losers. In 1973, more than half of all American manufacturing workers failed to complete high school, and only 6 percent attended some college, according to the National Association of Manufacturers. By 2001, nearly half completed high school and one-fourth attended some college.

North Carolina encapsulates the forces remaking American manufacturing. Between 2002 and 2005, the state lost 72,000 manufacturing jobs, about three-fourths in textiles, furniture-making and electronics, according to the North Carolina Commission on Workforce Development. At the same time, the state has become a rising powerhouse in lucrative new manufacturing sectors such as biotechnology, pharmaceuticals and sophisticated textiles.

As they grapple with change, North Carolina's workers and factory owners are helping answer a pressing question: What does the future hold for manufacturing in the United States?

**Adapting to a New Market**

"We didn't see it coming," the furniture man grimly declared.

Michael K. Dugan once ran Henredon Furniture Industries, which operated a plant in Spruce Pine, a former mining town in the rugged mountains in the western part of the state. There the company made hand-carved wooden bedroom furniture, once employing more than 1,000 people. Many lacked high school diplomas and some were illiterate, yet the factory provided a way for these workers to support families and to acquire modest homes and cars. It paid roughly $14 an hour, plus health and pension benefits.

Henredon's four-poster beds retailed for about $5,000 in the early 1990s, Dugan recalled. A few years later, similar models started showing up from the Philippines for less than $2,000. Now they can be found for $799, produced by workers in southern China who earn as little as 40 cents an hour.

Henredon first trimmed its workforce. Three years ago, it shut down the plant, eliminating the last 350 positions and adding to a wave of layoffs in surrounding Mitchell County, which has had roughly one-fifth of its jobs wiped out since 2000, according to the Employment Security Commission of North Carolina.

Many of the storefronts in Spruce Pine's brick downtown are empty. Restaurants and shops have closed, succumbing to a dearth of local spending power.

"The kids are moving out," said Brenda Smith, a youth pastor at a teen center. "They can't find anywhere

to work. There's Wal-Mart, and that's about it."

For 26 years, Phillip Wilson worked at Henredon as a master carver. Now, on most days, he wakes before dawn and drives to his new job -- the 5:30 a.m. shift as a prison guard at the medium-security Mountain View correctional facility. His pay is down 15 percent, forcing him into a second job at a used-appliance store to make ends meet.

Throughout the state, and indeed the nation, laid-off factory workers are typically able to find new jobs but mostly for lower pay. A June 2002 study published by the North Carolina Justice and Community Development Center found that workers who lost manufacturing jobs in 1999 and 2000 were earning 72 percent of their previous salaries six months later.

Furniture-making is typical of the manufacturing sectors that are shrinking in the United States. For many, labor represents a relatively high proportion of total costs, making them vulnerable to foreign competition. If factories cannot automate, they die.

The textile industry has been particularly aggressive in replacing people with machines. A half-century ago, a typical North Carolina textile worker operated five machines at once, each capable of running a thread through a loom at 100 times a minute. Now machines run six times as fast, and one worker oversees 100 of them.

With machines increasingly occupying the center of production, manufacturers want highly trained, literate workers at the controls. To meet the demand and help workers secure jobs, North Carolina has beefed up course offerings at its community colleges.

Three years ago, it set up Bionetwork, a training program based in community colleges, to feed workers into the state's growing biotech sector.

"All of the skills are closely tied to the workplace," said Norman Smit, Bionetwork's recruitment director.

Smit seeks students from declining areas of manufacturing. Given intensive training and a willingness to adapt, a textile or furniture worker can become a better-paid biotech technician, he says. As proof, he points to Regina Whitaker.

Ten years ago, straight out of high school, Whitaker went to work at a yarn texturing plant in Yadkinville, in the Piedmont region. Her mother had worked there for 30 years.

From midnight until 8 a.m., Whitaker tended to whirring machinery, alternately wishing for another job and worrying that she would actually have to find one: Her company was opening plants in China and Brazil and laying people off in Yadkinville.

"I couldn't see spending my life there," Whitaker said.

In January 2003, she enrolled in the first associate degree classes offered in biotechnology at Forsyth Technical Community College. Now 28, she graduated in July 2004 and was hired as a lab technician at Targacept, a biotech start-up in Winston-Salem that was spun off from R.J. Reynolds Tobacco. Where the tobacco giant had researched the use of nicotine to make people crave cigarettes, Targacept is focusing on the nicotine receptors in the brain to develop drugs for Alzheimer's disease and schizophrenia.

Whitaker said her salary is "significantly more" than the $13.40 an hour she made at the yarn factory.

"I'm not struggling now," she said. "Before, it was paycheck to paycheck."

**Textile Firm Finds a Niche**

Glen Raven Custom Fabrics was another Carolina textile operation whose future seemed in doubt. In the early 1990s, the company was still concentrated on products under siege from foreign competition -- pantyhose, luggage fabric and yarn for apparel. Throughout the Carolinas, other textile companies were vanishing.

Glen Raven managed to endure and prosper by refocusing on specialty industrial fabrics for outdoor furniture, boats and awnings -- expensive goods that require customization, high-end machinery and technical expertise.

Economists suggest this is the future for successful U.S. manufacturers: zeroing in on high-value products that tap America's technological advantages to offset high labor costs. This strategy has fostered a boom in exports of American-made industrial engines and machinery, aerospace gear and pharmaceuticals.

North Carolina has embraced this approach, aggressively pushing biotechnology development. In the past decade, the number of biosciences firms in the state has jumped to 386 from 131, and the number of workers has more than doubled from 20,000 to 47,000, according to the North Carolina Biotechnology Center, a government arm that promotes the industry.

At Research Triangle Park, a sprawling complex outside Raleigh-Durham, Biogen Idec has established one of the larger biomanufacturing facilities in the United States, making sophisticated pharmaceuticals. Entry-level workers with the necessary training earn $27,000 to $35,000 a year. Experienced production workers can make considerably more.

For Glen Raven, the focus on high-technology production has turned its factory floors into lonely expanses. In Norlina, N.C., a red-brick factory just down Route 1 from the town's lone traffic light, 225 people once made pantyhose, pushing baskets of nylon across the floor by hand. Now, 156 workers man computers that control acres of robotic arms and bobbins producing yarn.

The refashioning has positioned Glen Raven to profit from what many portray as the mortal threat to the Carolina textile industry: China now buys growing volumes of the company's products. Last year, North Carolina exported $52 million of textiles and fabrics to China, a fivefold increase from 2003.

Chinese factories increasingly use Glen Raven's fabrics to make sun umbrellas and upholstery for lounge chairs, sending many of these finished goods back across the Pacific to the United States.

The workers at these Chinese factories typically make less in a month than the price of a sun umbrella at an American retailer. Glen Raven's success allows the company to pay its American workers $10.50 to $22 an hour, plus benefits. Even at those wages, labor represents only 5 percent of the overall cost of turning fiber into fabric.

Put another way, the efficiency of the machines that have eliminated jobs at its plants has allowed Glen Raven to pay the remaining workers enough to afford cars, health care and homes. Some of those homes boast patios and lawns now shaded by sun umbrellas made in China using fabric woven just down the

road.

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# Beyond Wind and Solar, a New Generation of Clean Energy



By Juliet Eilperin
Washington Post Staff Writer
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PORTLAND, Ore. -- Oregon Iron Works has the feel of a World War II-era shipyard, with sparks flying from welders' torches and massive hydraulic presses flattening large sheets of metal. But this factory floor represents the cutting edge of American renewable-energy technology.

The plant is assembling a test buoy for Finavera Renewables, a Canadian company that hopes to harness ocean waves off the coast of Oregon to produce electricity for U.S. consumers. And Finavera is not Iron Works' only alternative-energy client: So many companies have approached it with ideas that it has created a "renewable-energy projects manager" to oversee them.

"In the last year, it's just exploded with ideas out there," said Vice President Chandra Brown. "We like to build these creative new things."

As policymakers promote alternative energy sources to reduce the United States' emissions of greenhouse gases and its dependence on foreign oil, entrepreneurs are becoming increasingly inventive about finding novel ways to power the economy.

Beyond solar power and wind, which is America's most developed renewable-energy sector, a host of companies are exploring a variety of more obscure technologies. Researchers are trying to come up with ways to turn algae into diesel fuel. In landfills, startups are attempting to wring energy out of waste such as leaves, tires and "car fluff" from junked automobiles.

This push for lesser-known renewables -- which also includes geothermal, solar thermal and tidal energy -- may someday help ease the country's transition to a society less reliant on carbon-based fuels. But many of these technologies are in their infancy, and it remains to be seen whether they can move to the marketplace and come close to meeting the country's total energy needs.

Some technologies are more advanced, though still small in the nation's overall energy mix. Nevada boasts 15 geothermal plants, with the capacity to generate enough electricity for 73,000 homes. California utilities are looking at solar technology that would use mirrors to heat water and spin turbines in desert power plants.

Rep. Jay Inslee (D-Wash.), whose Bainbridge Island home overlooks Puget Sound, said that after being thrashed around by the ocean as he kayaked near his house, he became convinced that efforts such as Finavera's could succeed.

"There's just such an enormous power out there," Inslee said, noting that there is nearly 900 times as much energy in a cubic meter of moving water as in a cubic meter of air. "I was wondering how we

could capture that."

Finavera's chief executive, Jason Bak, believes he knows how. The equipment his company designed, called AquaBuOY, aims to generate electricity from the vertical motion of waves. The buoy, anchored in an array two to three miles offshore, will convert the waves' motion into pressurized water using large, reinforced-rubber hose pumps. As the buoy goes up the peak of a wave and down into its trough, it forces a piston in the bottom of the buoy to stretch and contract the hose pumps, pushing water through. This drives a turbine that powers a generator producing electricity, which would be shipped to shore through an undersea transmission line.

"This is the new source of power," Bak said. "It's the highest-energy-density renewable out there. Wind is like light crude oil, and water is like gasoline."

In many cases, Americans are working with overseas experts who have more experience developing renewable energy. This month, Iceland América Energy -- a partnership between Icelandic and U.S. entrepreneurs -- will start drilling just west of California's Salton Sea to build a geothermal power plant to supply Pacific Gas and Electric with 49 megawatts of electricity by 2010.

Magn?s J?hannesson, Iceland America's chief executive, said the facility will pump naturally heated water from underground, run it through turbines to generate electricity and re-inject it into the earth, "making it a renewable, giant battery that can run for 20, 30, 50 years."

Iceland America has several other U.S. geothermal projects in the works, including a potential second Salton Sea plant that would serve Los Angeles and a home-heating plant for the ski resort town of Mammoth Lakes, Calif.

"There's huge potential for geothermal energy in this country, especially on the West Coast," J? hannesson said.

It is hard to predict what portion of the country's needs could be met by these emerging technologies. The United States is already the world's largest producer of geothermal electricity, with 212 plants generating 3,119 megawatts. A panel convened by the Massachusetts Institute of Technology concluded in a recent report that by 2050, geothermal plants could produce 100 gigawatts, which would be equivalent to 10 percent of current U.S. electricity capacity.

"That level would make it comparable to the current capacity of all our nuclear power plants or all our hydroelectric plants," wrote the panel's chair, MIT chemical engineering professor Jefferson W. Tester, in an e-mail.

A 2005 report by the Electric Power Research Institute, an industry consortium, said there is "significant" wave energy potential along America's coasts, predicting that it, too, could eventually generate as much electricity as the entire hydropower sector.

Both the Bush administration and Congress are promoting renewable energy through a mix of federal largesse and mandates.

Last month the House passed, as part of its energy bill, a requirement that by 2020, renewable energy must account for at least 15 percent of private utilities' energy supply, and authorized $50 million for marine energy research over the next five years.

Over the next two years, the Energy Department will offer up to $13 billion in loan guarantees for energy ventures that "avoid, reduce or sequester air pollutants and greenhouse gases," said department spokeswoman Julie Ruggiero, "to make new and emerging clean-energy technologies cost-competitive with traditional sources of energy."

Still, it will be years before many of these projects will come on line. Oregon Iron Works is nearly done constructing the AquaBuOY prototype, which will be 72 feet tall and 12 feet in diameter, and Finavera hopes to install it off the Oregon coast as early as next week. After testing the technology and applying for the necessary federal permits, Finavera officials hope that by 2010 or 2011 they can operate two wave parks -- one off Bandon, Ore., and another off Trinidad, Calif. -- that would each span two to three square miles and produce 100 megawatts, enough for 35,000 homes. They plan to start up another wave-power operation in British Columbia around the same time.

Operating equipment in the hostile environment of the ocean poses challenges, however. Josh Pruzek, who oversees government contracts as military marine manager at Oregon Iron Works, said the company uses high-grade steel that is less vulnerable to corrosion, and designs parts to be easily maintained.

The power of moving water can also overwhelm high-tech equipment. In December, Verdant Power placed turbines off New York City's Roosevelt Island amid much fanfare, promising to harness the tides of the East River and convert that energy into electricity. By last month, all six of the turbines, battered by the current's strength, had been shut down. The company is repairing and redesigning its equipment.

Still, such projects are popular with politicians across the nation, from New York Mayor Michael R. Bloomberg (I) to Oregon Gov. Ted Kulongoski (D), who is hoping to make his state a breeding ground for renewable-energy projects. David Van't Hof, Kulongoski's sustainability policy adviser, said government officials are exploring ideas, from solar projects on the eastern side of the state to biomass energy culled from Oregon's forests, in an effort to generate 25 percent of the state's energy from renewable sources by 2025.

"Wind's going to continue to be the king, both in Oregon and the nation, for the next five years," Van't Hof said, but that will last only for so long. "People are already asking, 'What's next after wind?' "

*Staff writer Steven Mufson in Washington contributed to this report.*

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